

“CQ Universe”—Is Anyone Out There?

A look at the growing role of ham radio operators in SETI—Search for Extra-Terrestrial Intelligence—and what you'll need to build your own SETI “station.”

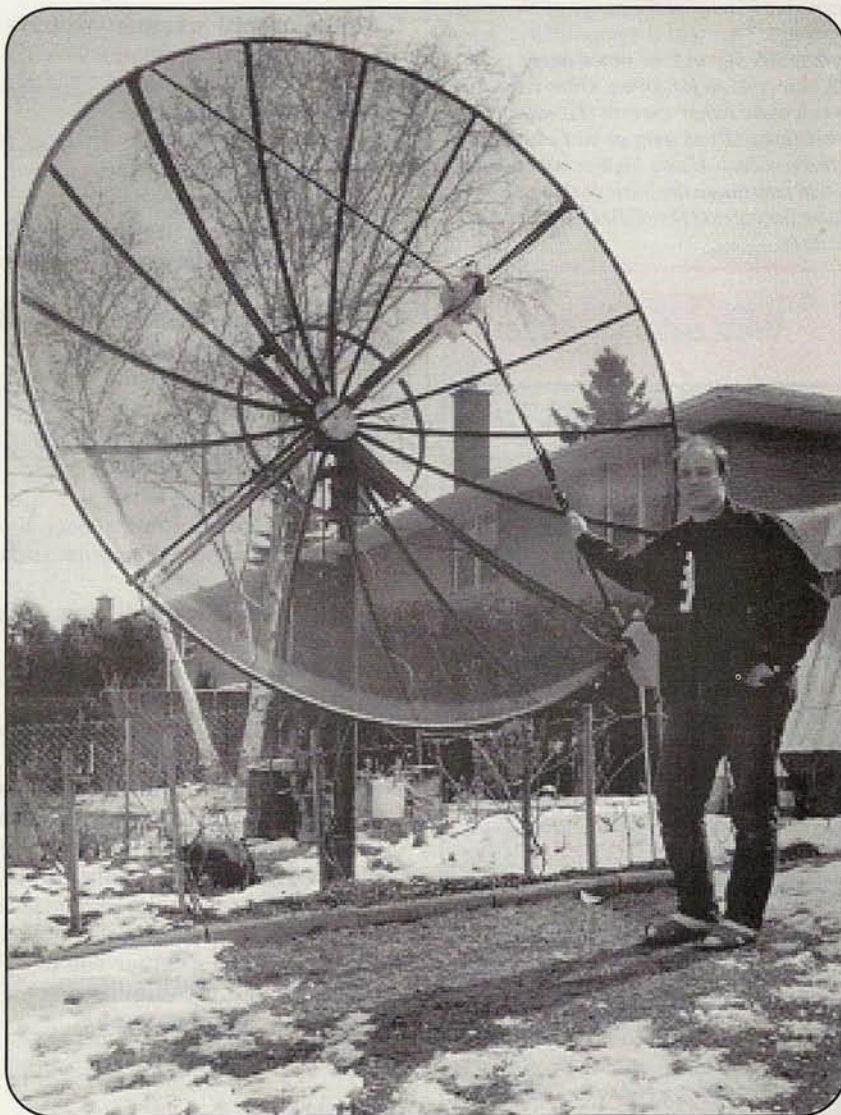
By Denis Jakac, VE3ZXN*

Are we alone in this vast universe? I think that, at one time or another, just about everyone has asked that question while gazing up at the skies. I know I have, many times. And now, through my involvement in amateur radio, I'm getting the chance to help listen for an answer to that age-old question.

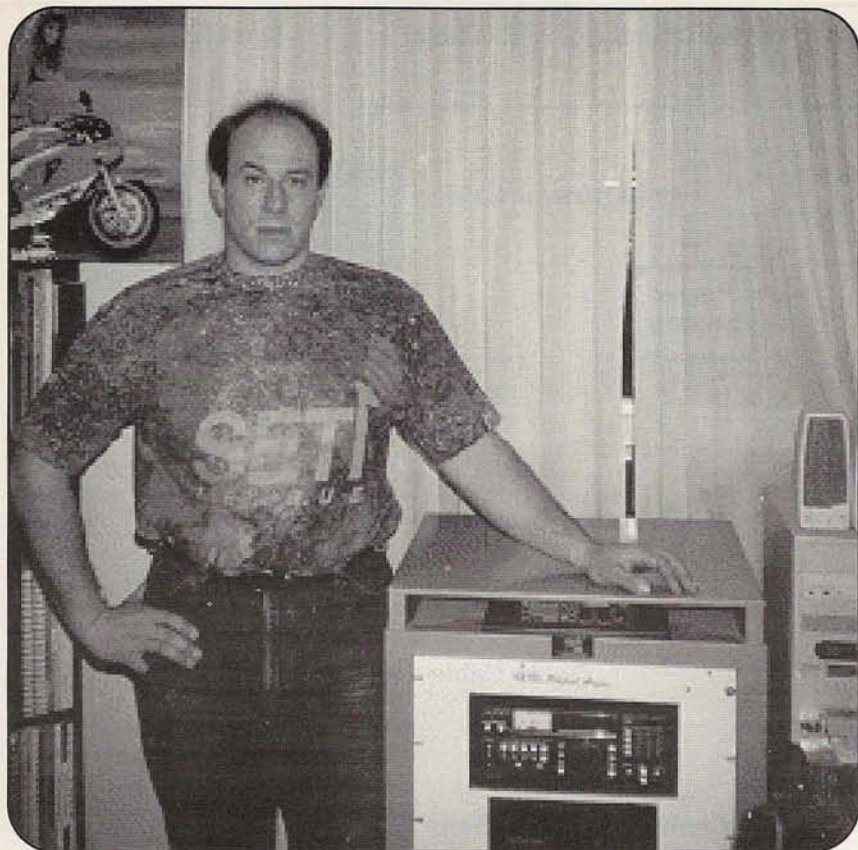
After years of doing nothing but reading and wishing I could have something to add to “SETI” research, I discovered The SETI League, Inc. It was after joining this organization, that my SETI interests began to grow on a large scale. I learned that the SETI League's goal is to have 5,000 amateur stations on-line worldwide as participants in its “Project Argus” all-sky survey.

Big, expensive radiotelescopes are very sensitive but highly-focused. If we knew where to listen for signals from other civilizations, one of these “big ears” would be far better-suited for receiving any messages than would 5,000 or 10,000 amateur stations. *If we knew where to listen.* A network of 5,000 amateurs scattered around the world can do something no radiotelescope can: listen in many directions simultaneously. And that's the whole idea behind Project Argus. If the Project Argus participants, who are collectively scanning the whole sky, can detect possible signals from extraterrestrial sources, then we can give the pros with the radiotelescopes an idea of where to point and what to listen for.

**Denis Jakac, VE3ZXN, listens for signs of life on other planets from his home in Etobicoke, Ontario. His SETI station was the first to be activated in Canada.*



The author with his SETI antenna, a 10-foot mesh satellite TV dish with a 1- to 2-GHz helix feed. (Photos courtesy of the author)



The author's SETI station consists of an ICOM R-7000 receiver, a Timewave DSP-599ZX digital signal processing unit, and a Pentium-Pro 150-MHz computer with a Sound Blaster 16 sound card.

The frequency range of interest is 1420 to 1660 MHz., the so-called Hydrogen/Hydroxyl line. Every element has a spectral "signature," a frequency at which it naturally emits radiation. Astronomers determine the makeup of stars and planets by looking for these "signature" frequencies. The spectral frequency of neutral hydrogen atoms, the most common element in the universe, is roughly 1420 MHz. Hydroxyl (hydrogen+oxygen) gives off signals at about 1660 MHz. As it happens, the area between these frequencies is among the quietest "regions" of the spectrum (part of the so-called "microwave window" between 1 and 10 GHz in which there's very little stellar or other natural noise).

Since H (hydrogen) + HO (hydroxyl) combine under the right conditions to create H₂O (water), scientists refer to this region of the spectrum as "the water hole." Based on the assumption that any civilization with radio astronomy would be aware of this region (due both to its quiet and to the abundance of hydrogen and hydroxyl in the universe), SETI researchers believe this "water hole" is a

natural spot for civilizations to send out interstellar messages. Therefore, this is where Project Argus members are concentrating their efforts.

Building a SETI Station

Project Argus involves amateur SETI receiving stations which are owned, maintained, and operated (and paid for) solely by the participant. It is my goal here, as a layman, to describe how simple it can be to assemble an average amateur SETI station. Of course, just like your amateur radio station, it can grow quite involved once you're into it. I've included a diagram of a basic SETI system which will give you an idea of what is involved (see Figure).

First off, you need a dish or a Yagi array with sufficient gain. What is sufficient? It seems that you're best off with a dish; a 10-foot TVRO (satellite TV Receive Only) dish will suit nicely (*To get the same level of gain, about 32 dBi, without a dish, you would need an array of four to eight Yagis, according to SETI League Executive Director Dr. Paul Shuch,*

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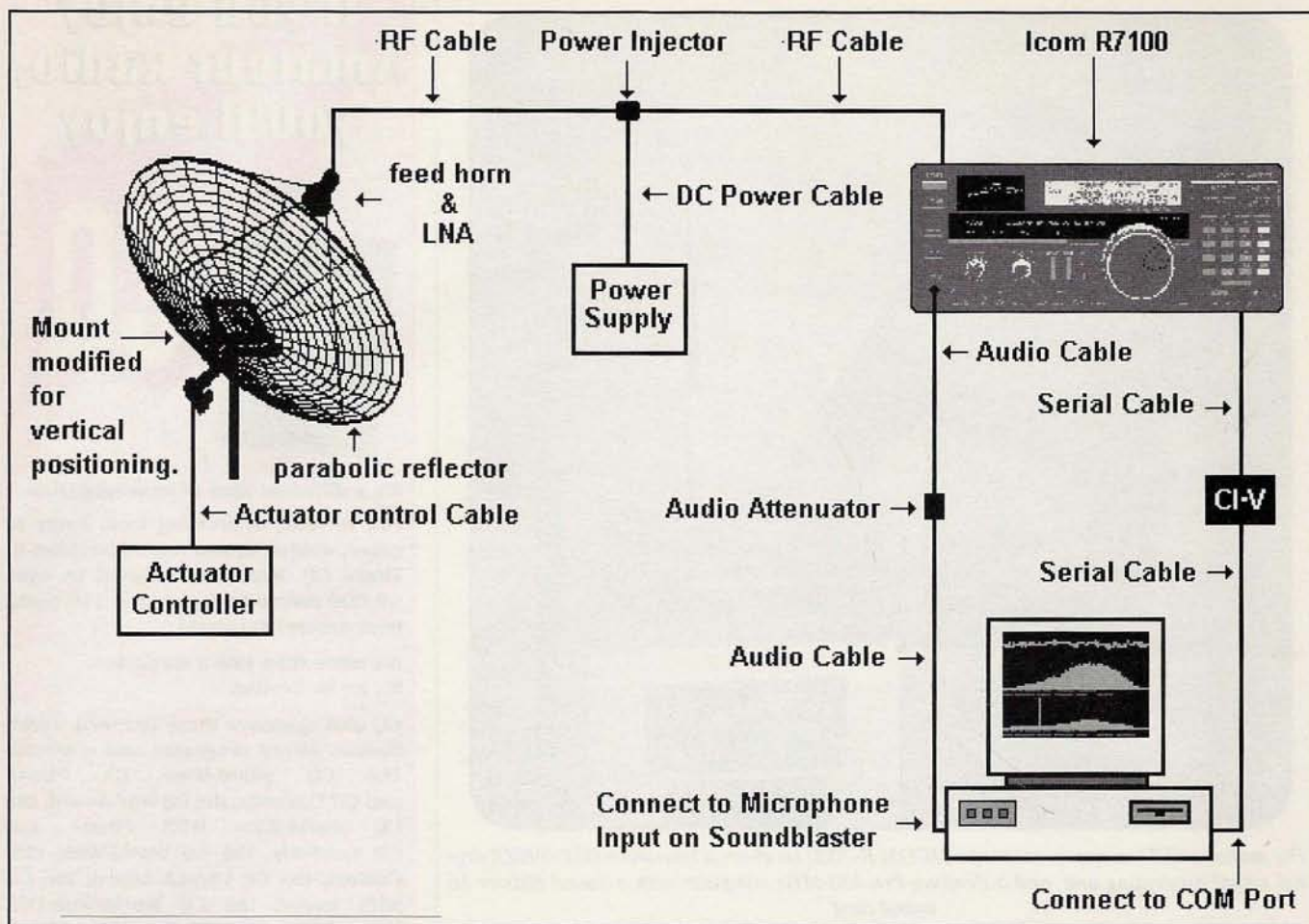
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Block diagram of a typical amateur SETI station, consisting of a microwave antenna, receiver, and computer with sound card.
(Diagram by, and courtesy of, Daniel Fox, KF9ET)

N6TX. Shuch also notes that a Yagi array will have a narrow bandwidth and will be able to tune only "a tiny slice" of the spectrum of interest, which, he says, "is why most of us use dishes."—ed.). A 10-foot dish is widebanded and doesn't have too narrow a beamwidth, but it also won't provide much sensitivity beyond a few light years. But who's to say how much power an E.T.I. (Extra-Terrestrial Intelligence) source may be transmitting? How large an antenna array? Do they have an inter-stellar repeater? How about an out-of-this-world version of those "big gun" moonbouncers here on Earth whose huge arrays allow us little guys a rare EME contact? (*Alpha-Centauribounce?*—ed.)

Back to the dish. The best thing about the whole deal is that no rotator is needed. Since Project Argus is based on an all-sky survey and not necessarily individual targeted stars, the dish can operate in "drift-scan" mode, using the Earth as the rotator. My station uses the original dish mount, locked in position facing due

south, and set at a particular elevation or declination.

A feed for the dish must be constructed or purchased and can vary in design. This can be a Chaparral-type feed, used widely in the TVRO industry, or a few-turn helix. Ideally, you would want a feed with which you can receive both right- and left-hand circular polarization, to make sure you can cover all polarization phases. You'll also want to have a receive LNA (low noise amplifier) mounted at the dish to provide minimum noise/maximum signal amplification. As far as cable goes, unless you opt to mount a downconverter at the feed, use the best you can afford. My station presently uses 9913 coax, which will be upgraded to Heliac (hardline) in the near future.

Listening Equipment and Techniques

In the shack, you don't have too many options. Unless you use a downconvert-

er to bring the 1.4- to 1.6-GHz signals down to frequencies your current equipment can receive (several converter options are presented on the SETI League Web site, see "Resources"), you'll have to use an all-mode radio which covers this frequency range. Typical radios are ICOM's R7000, R7100, R8500, and R9000, and the new AOR 5000.

There are different approaches you can use as far as scanning (listening) goes. Most Project Argus participants have opted to scan one frequency a day. Since sensitivity increases with integration time, the more time we spend on one channel, the greater the chance we have of hearing "the signal." I should clarify "hearing the signal." You won't actually hear it, but *see* it. This is a job for DSP (digital signal processing).

After you connect the coax cable to the receiver, you want to select the upper sideband mode. Experts have theorized that any signal we might hear will most likely be a pulsed-type carrier maximiz-

"One station may search for years, never hearing a single peep, but 5,000 stations worldwide could greatly enhance the possibility of receiving a signal from an extraterrestrial civilization."

ing on power generation at the transmitting end. This carrier will generate a tone in USB mode which will be recognized by the DSP program. The audio output of the receiver is fed into a computer sound card. Here, it is digitized and processed by FFT (Fast Fourier Transform) and displayed/recorded on your computer. The DSP processing allows you to dig 20dB or so into the noise. There are various DSP software programs currently available, many of which can be browsed through and downloaded from the SETI League Web page.

My present system is processing 12.5-kHz chunks of bandwidth at a resolution of 12.2 Hz. This is derived by dividing 12.5 kHz by the 1024 points in my FFT software and is an acceptable approach among our participants: close enough to the system's design goal of 10-Hz resolution. Bandwidth choice is based on several factors, each of which could be an article in itself, and is left to the individ-

ual SETI enthusiast to decide (again, see "Resources" for additional information).

In Numbers, There Is Knowledge

One station may search for years, never hearing a single peep, but 5,000 stations worldwide could greatly enhance the possibility of receiving a signal from an extraterrestrial civilization. I feel that we are now in an age where the tools to succeed are within our grasp. Technological advances are increasing at a dramatic

rate. Computer processing power almost doubles every year. Maybe if there is enough public interest and support, one day Congress will reinstate NASA's funding for SETI research, and we amateurs won't have to go it alone.

Will You Join Us?

I hope that I have sparked some interest among the readers of *CQ VHF*, and that—with your help—one day we will achieve our goal, finally answering the question: "Are we alone?" ■

Editor's Note: CQ VHF would like to thank the SETI League, Inc., and Executive Director Paul Shuch, N6TX, for providing technical assistance and illustrations for this article.

Resources

For additional information, station options, and photos, visit the SETI League's World Wide Web page at <<http://www.setileague.org>>, contact The SETI League, Inc., P.O. Box 555, Little Ferry, NJ 07643, or send e-mail inquiries to <info@setileague.org>. Detailed technical articles on station design considerations are also available on the SETI League Web site at <<http://www.setileague.org/articles/articles.htm>>.

Reader Snapshot !



Meet CQ VHF Readers...Ray (W6JXW) and Sheryle (KF4NYE) Schneider

Ray and Sheryle Schneider of Big Stone Gap, Virginia, sent us this photo of them taken at the Dayton Hamvention earlier this year. For those of you who haven't been to Dayton, Ray and Sheryle are in the stands overlooking the main arena, one of five large exhibit halls packed with ham radio manufacturers and dealers. And then there's the flea market...

"This was our first time at Dayton," say Ray and Sheryle. "We snapped up some good buys, found some items we could not find anywhere else, and learned a lot. We plan on going next year."

The Schneiders also say they enjoy reading *CQ VHF*, "especially articles on working Mir and satellites."

If you'd like to be considered for our "Reader Snapshot" column, please tell us about yourself in 150 words or less and mail, along with a photo, to: CQ VHF Reader Snapshot, 76 N. Broadway, Hicksville, NY 11801. Entries become our property and cannot be returned. If we publish your "snapshot," we'll give you a one-year gift subscription (or extension) to CQ VHF magazine.